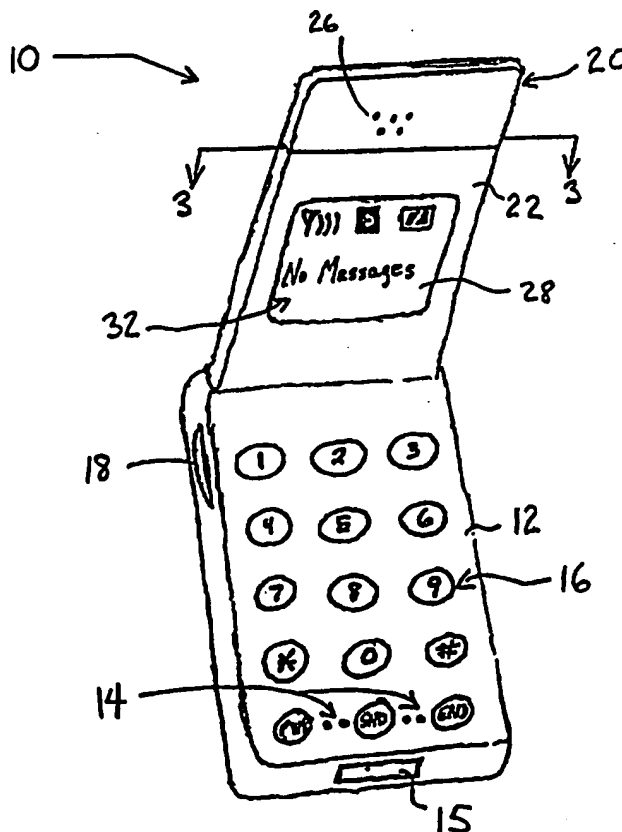


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(54) Title: ELECTRONIC DEVICE HAVING A REVERSIBLE DISPLAY**(57) Abstract**

An electronic device having a main body which includes a main surface having an input device for inputting information. The electronic device further includes a flip that is rotatably attached to the main body. The flip includes a front surface and a rear surface wherein the flip is rotatable between a closed position wherein the front surface is adjacent the main surface and an open position wherein the flip is upstanding relative to the main surface. In addition, the device includes front and rear displays which are located on the front and rear surfaces, respectively, for displaying information.



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ELECTRONIC DEVICE HAVING A REVERSIBLE DISPLAY

Field of the Invention

This invention relates to electronic devices which utilize a display, and more particularly, to an electronic device such as a wireless telephone having a two sided and reversible display so as to enable a user to view a display when a cover, or flip, of the electronic device is closed.

Background of the Invention

It is frequently desirable to reduce the size of a portable electronic device such as a wireless telephone so as to increase convenience and portability. Many phones of this type include an input device for inputting a telephone number or other data, a display for displaying data and a cover or flip. The flip may be rotatably attached to a main body of the phone such that when the phone is not in use, the flip may be rotated to a closed position wherein portions of the main body are concealed. In a first type of phone design, the display and input device are located in upper and lower portions, respectively, of the main body. Further, the flip is sized such that the input device, and not the display, is concealed when the flip is closed. In a second type of phone design, the display is located in the flip whereas the input device is located in the main body. In this configuration, the flip is folded over onto the input device when the flip is closed thus concealing the display and forming a clamshell design which is smaller in size than the first phone design.

Frequently, a liquid crystal display (LCD) or similar device is used to display information on a wireless telephone. Such displays include a liquid crystal material which is positioned between front and rear glass plates to form an LCD cell. A surface treatment is applied to an inner surface of each glass plate such that molecules in the liquid crystal material near each inner surface align in the direction of the surface treatment. In LCDs known as twisted nematic LCDs, the inner surfaces are positioned orthogonal to each other such that a 90 degree twist is formed in the liquid crystal material.

A front and rear polarizer is formed on an outer surface of the front and rear glass plates, respectively. Light which is incident on the front polarizer becomes linearly polarized and subsequently passes through the first glass plate. The light is then rotated 90 degrees by the liquid crystal material and passes through the second glass plate and rear polarizer. In a
5 reflective display, the rear polarizer further includes a diffuse reflector which may be fabricated from brushed aluminum. The reflector serves to reflect the light back through the rear polarizer and LCD cell to ultimately emerge from the front polarizer as a silver-gray color.

Further, an electric field may be applied to the LCD cell which causes the liquid crystal molecules to rotate in the direction of the electric field. As a result, the incoming light is
10 absorbed by the rear polarizer. When this occurs, an observer sees, for example, a black character on a silver-gray background. In order to improve visibility, a backlighting device which includes a light source such as a cold cathode fluorescent tube (CCFT) or a hot cathode fluorescent tube (HCFT) may be used.

However, a user is not able to view the LCD when the flip is closed in a clamshell style
15 phone. As such, information on the LCD cannot be viewed when the phone is in its most space efficient configuration.

Summary of the Invention

This invention relates to an electronic device having a main body which includes a main surface, having an input device for inputting data. The electronic device further includes a flip
20 that is rotatably attached to the main body. The flip includes a front surface and a rear surface wherein the flip is rotatable between a closed position wherein the front surface is adjacent the main surface and an open position wherein the flip is upstanding relative to the main surface. In addition, the device includes front and rear displays which are located on the front and rear surfaces, respectively, for displaying information.

25 Brief Description of the Figures

FIGURE 1 is a view of a wireless telephone having a flip located in an open position in accordance with the present invention.

FIGURE 2 is a view of the wireless telephone wherein the flip is in a closed position.

FIGURE 3 is a cross sectional view of the wireless telephone along section line 3-3 of FIGURE 1.

FIGURE 4 is a cross sectional view of the wireless telephone along section line 4-4 of
5 FIGURE 2.

Detailed Description of the Invention

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail specific embodiments, with the understanding that the present disclosure is to be considered as an example of the principles of
10 the invention and not intended to limit the invention to the specific embodiments shown and described. In the description below, like reference numerals are used to describe the same, similar or corresponding parts in the several views of the drawing.

Referring to FIGURE 1, in conjunction with FIGURE 2, a wireless telephone 10 such as cellular or cordless phone having a reversible display in accordance with the present invention is
15 shown. Although the present invention is described in relation to phones, it is noted that the present invention may also be utilized in conjunction with other electronic devices such as personal digital assistants (PDAs), cameras, pagers, personal computers, radios, recording and/or playback devices, calculators, televisions and others.

The phone 10 includes a main body 12 having a microphone 14, an input device 16 such
20 as a touch sensitive device, touch screen, pointing device, mouse pointer, keypad and the like for inputting phone numbers or other data. In addition, the main body 12 may include a selection mechanism 18 for selecting stored information such as phone numbers, an antenna 11, accessory connector 15, battery, circuit boards and other components typically used for providing phone functionality. The phone 10 further includes a cover or flip 20 having a front surface 22 and a
25 rear surface 24. The front surface 22 includes a speaker 26 and a front display 28 which serves to

display information associated with operation of the phone 10 such as whether or not a message has been received, battery strength, signal strength and others. The flip 20 is rotatably attached to the main body 12, thus enabling rotation of the flip 20 between an open position and a closed position relative to the main body 12. Referring to FIGURE 1, the flip 20 is shown in the open position. In this position, the flip 20 is located in a substantially upstanding orientation relative to the main body 12, thus enabling a user to view the front display 28 and also providing access to the input device 16.

Referring to FIGURE 2, the flip 20 is shown in the closed position. The flip 20 may be moved to the closed position by rotating the flip 20 downward toward the main body 12 until the flip 20 is oriented substantially parallel to the main body 12 and the front surface 22 is adjacent the main body 12, thus reducing the overall size of the phone 10. In this position, the input device 16 and the front display 28 are concealed by the flip 20. In accordance with the present invention, the rear surface 24 of the flip 20 includes a rear display 30 which serves to display information, when the flip 20 is in the closed position, similar to that displayed on the front display 28. In one embodiment, software may be used to invert an image 32 displayed on the front display 28 and to generate an inverted image 34 which is then displayed on the rear display 30. This enables the user to view information associated with operation of the phone 10, such as whether or not a message has been received, battery strength, signal strength and others, even when the front display 28 is concealed.

Referring to FIGURE 3, a cross sectional view along section line 3-3 of FIGURE 1 is shown. The flip 20 further includes a liquid crystal display (LCD) 36 having the front 28 and rear 30 displays. The front 28 and rear 30 displays are located adjacent front 38 and rear 40 optical guides, respectively. The flip 20 further includes front 42 and rear 44 light sources which are located adjacent light gathering ends 46 of the front 38 and rear 40 optical guides, respectively. In one embodiment, the front 42 and rear 44 light sources may include a cold cathode fluorescent tube (CCFT), hot cathode fluorescent tube (HCFT), a light emitting diode (LED), or other similar lighting device. The front 28 and rear 30 displays are located adjacent front 48 and rear 50 apertures formed in the front 22 and rear 24 surfaces which enable the user to view the front 28 and rear 30 displays, respectively. When the flip 20 is in the open position,

circuitry associated with the phone 10 causes the rear light source 44 to be turned on and the front light source 42 to be turned off. Light 52 generated by the rear light source 42 is captured by the light gathering end 46 of the rear optical guide 40. The rear optical guide 40 then directs the light 52 toward the rear display 30. This serves to backlight the front display 28, thus
5 improving visibility of the front display 28. In addition, it is noted that the LCD 36 may be a transfective LCD.

Referring to FIGURE 4, a cross sectional view along section line 4-4 of FIGURE 2 is shown. As previously described, the front surface 22 is adjacent the main body 12 when the flip 20 is moved to the closed position, thus concealing the front display 28. In addition, as also
10 previously described, the inverted image 34 is displayed on the rear display 30 when the flip 20 is moved to the closed position. When this occurs, circuitry associated with the phone 10 causes the front light source 42 to be turned on and rear light source 44 to be turned off. Light 54 generated by the front light source 42 is then captured by the light gathering end 46 of the front optical guide 38 and directed toward the front display 28. As such, the direction of the
15 illumination used for backlighting is reversed relative to that which occurs when the flip 20 is in the open position. This serves to backlight the rear display 30, thus improving visibility of the rear display 30 when the flip 20 is in the closed position.

Referring back to FIGURE 3, the flip 20 may further include a movable light inhibiting element 56, such as a door, which is positioned so as to cover and uncover the rear aperture 50
20 when the flip 20 is in the open and closed positions, respectively. In FIGURE 3, the element 56 is shown covering the rear aperture 50. In this position, the element 56 shields the rear display 30 from outside light 58, thus further improving visibility of the front display 28 when the flip 20 is in the open position. Referring to FIGURE 4, the element 56 may then be moved away from the rear aperture 50 to enable viewing of rear display 30 when the flip 20 is in the closed
25 position.

Alternatively, the light blocking element 56 may be a passive or active light filter that is stationary. In this configuration, the light filter is adapted to absorb or redirect light incident on the rear display 30 so as to improve visibility of the front display 28 when the flip 20 is in the open position. The light filter may also be adapted to let light through to allow viewing of the

rear display 30 when the flip 20 is in the closed position.

Thus it is apparent that in accordance with the present invention, an apparatus that fully satisfies the objectives, aims and advantages is set forth above. While the invention has been described in conjunction with specific embodiments, it is evident that many alternatives, modifications, permutations and variations will become apparent to those skilled in the art in light of the foregoing description. Accordingly, it is intended that the present invention embrace all such alternatives, modifications and variations as fall within the scope of the appended claims.

What Is Claimed Is:

1. An electronic device, comprising:
a main body having a main surface which includes an input device for inputting data;
a flip rotatably attached to said main body, said flip having a front surface and a rear surface wherein said flip is rotatable between a closed position wherein said front surface is adjacent said main surface and an open position wherein said flip is upstanding relative to said main surface; and
front and rear displays located on said front and rear surfaces, respectively, for displaying information.
2. The device according to claim 1, wherein said front display displays information which is substantially similar to that displayed on said rear display.
3. The device according to claim 1, wherein said information is related to operation of said electronic device.
4. The device according to claim 1, wherein said front and rear displays are backlit.
5. A portable electronic device, comprising:
a main body having a main surface which includes an input device for inputting data;
a flip rotatably attached to said main body, said flip having a front surface and a rear surface, wherein said flip is rotatable between a closed position wherein said front surface is adjacent said main surface and an open position wherein said flip is upstanding relative to said main surface;
a front display located on said front surface for displaying information when said flip is in said open position, wherein said front display is concealed when said flip is in said closed position; and

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a rear display located on said rear surface for displaying information when said flip is in said closed position.

6. The device according to claim 5, wherein said front display displays information which is substantially similar to that displayed on said rear display.

7. The device according to claim 5, wherein said information is related to operation of said electronic device.

8. The device according to claim 5, further including a liquid crystal display which includes said front and rear displays.

9. The device according to claim 5, wherein said front display is backlit when said flip is in said open position.

10. The device according to claim 5, wherein said rear display is backlit when said flip is in said closed position.

11. The device according to claim 5 wherein said flip further includes a light filter for improving visibility of the front display.

12. A portable communication device, comprising:

a main body having a main surface which includes an input device for inputting data;

a flip rotatably attached to said main body, said flip having a front surface and a rear surface, wherein said flip is rotatable between a closed position wherein said front surface is adjacent said main surface and an open position wherein said flip is upstanding relative to said main surface;

a front display located on said front surface for displaying information when said

flip is in said open position, wherein said front display is concealed when said flip is in said closed position;

a rear display located on said rear surface for displaying information when said flip is in said closed position;

a front backlight device for backlighting said rear display when said flip is in said closed position;

a rear backlight device for backlighting said front display when said flip is in said open position; and

a door located in said flip, said door being movable between a closed position wherein said door covers said rear display when said flip is in said open position and an open position wherein said door does not cover said rear display when said flip is in said closed position.

13. The device according to claim 12, wherein said front and rear backlight devices include a cold cathode fluorescent tube or a hot cathode fluorescent tube.

14. The device according to claim 12, wherein said front and rear backlight devices include a light emitting diode (LED).

15. The device according to claim 12, wherein said front and rear backlight devices are located adjacent rear and front optical guides, respectively.

16. The device according to claim 12, further including a liquid crystal display (LCD) which includes said front and rear displays.

17. The device according to claim 16, wherein said LCD is positioned between said front and rear optical guides.

18. The device according to claim 12 wherein said device is a wireless telephone.
19. The device according to claim 12 wherein information displayed on said front display is substantially similar to that displayed on said rear display.
20. The device according to claim 12 wherein said information is related to operation of said device.
21. The device according to claim 12 wherein an image displayed on said first display is inverted to form an inverted image which is then displayed on said rear display.

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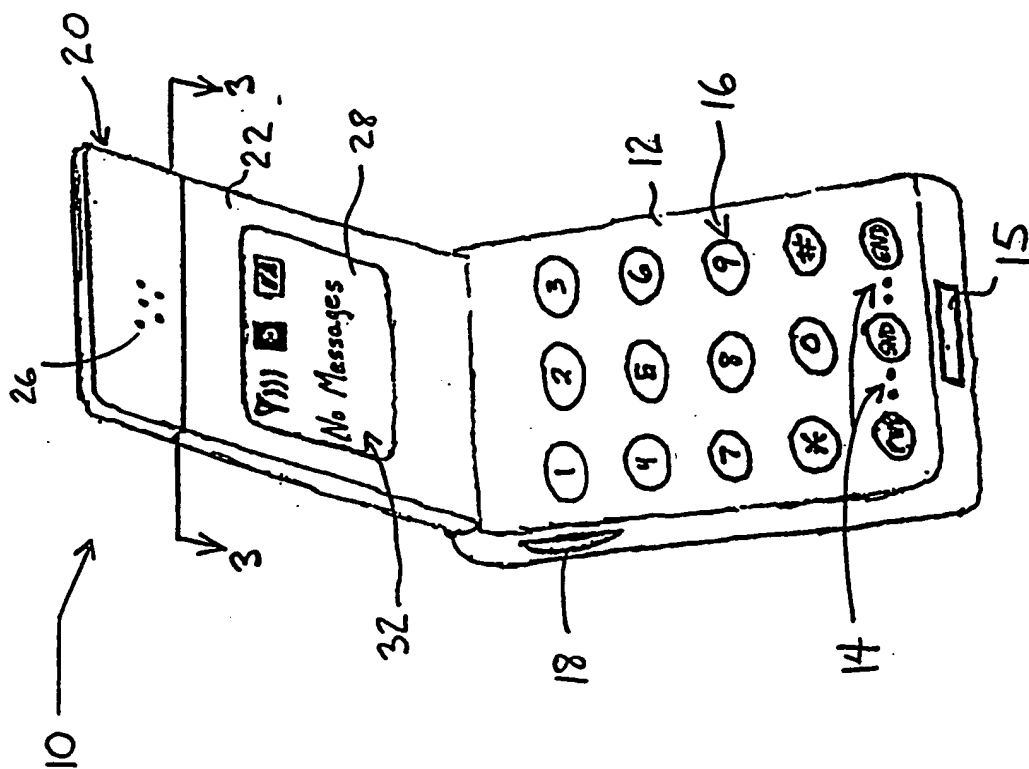


FIG 1

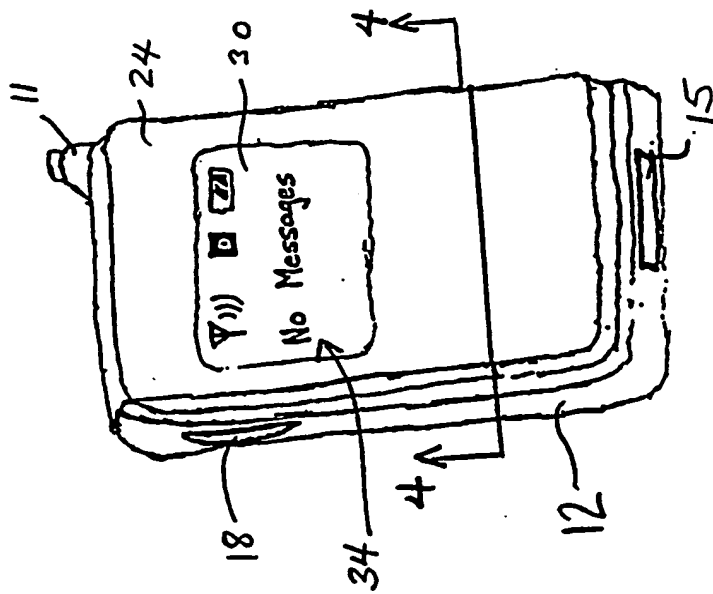


FIG 2

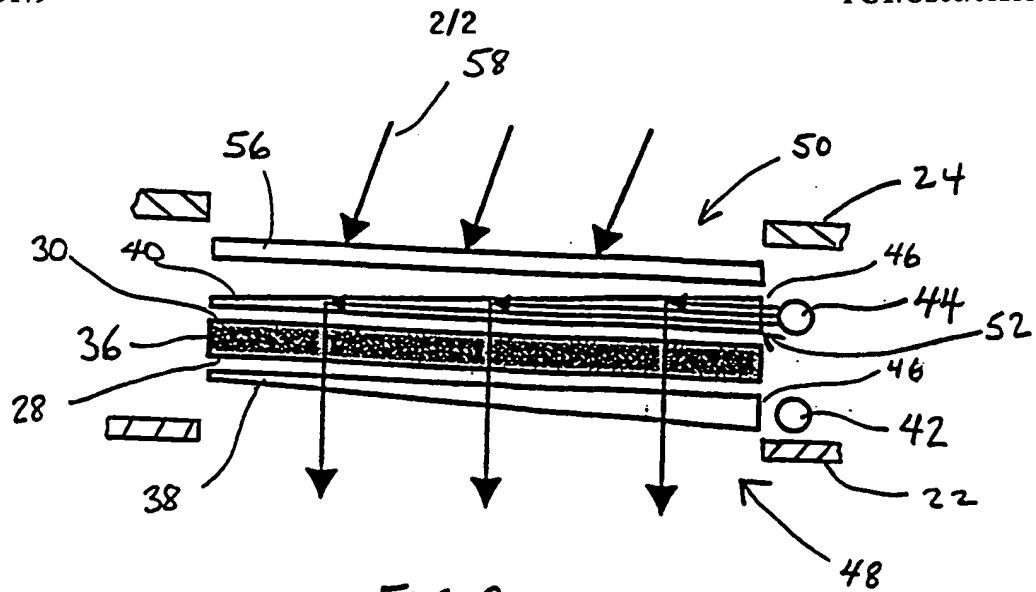


FIG 3

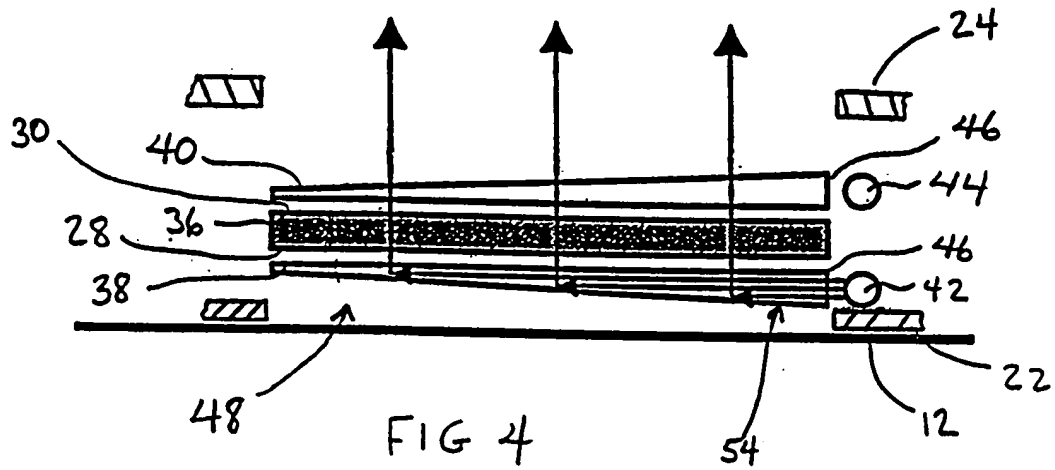


FIG 4

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	<p>WO 98 38822 A (MOTOROLA INC) 3 September 1998 (1998-09-03) column 2, line 15 -column 3, line 30; figures 1-3</p>	<p>1-3,5-8</p> <p>12</p>
X	<p>US 5 796 577 A (OUCHI GENJIRO ET AL) 18 August 1998 (1998-08-18) column 1, line 55 -column 2, line 42; figure 1</p>	<p>1-3,5-7</p>
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E A	GB 2 343 324 A (SAMSUNG ELECTRONICS CO LTD) 3 May 2000 (2000-05-03) page 2-4; figures 1-4 —————	1-3, 5-8 12

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